

Practice Tests

Answers

Practice Test:
Basic Math Review

1. What is the value of the following?

$$\frac{3}{5} + \frac{3}{5}$$

- ☒ a. 1.2
- b. 2.3
- c. 1.9
- d. 0.5

2. What is the value of the following?

$$\begin{array}{r} 15 \\ 14 \\ \hline 23 \\ 16 \end{array}$$

- a. 0.98
- b. 0.54
- c. 2.4
- ☒ d. 0.75

3. What is the value of the following?

$$\begin{array}{r} 23 \\ 11 \\ \hline 2 \\ 5 \end{array}$$

- a. 5.43
- ☒ b. 5.23
- c. 5.01
- d. 5.55

4. Solve the following x:

$$14x = 57$$

- a. 4.12
- b. 4.34
- ☒ c. 4.07
- d. 4.23

5. Solve the following x:

$$(23)(15+x) = 157$$

- a. -8.17
- b. 8.17
- c. 2.41
- d. 1.23

6. Solve the following x:

$$\frac{15}{x} + \frac{23}{54} = 254$$

- a. 0.065
- b. 0.032
- c. 0.059
- d. 0.043

7. Solve the following x:

$$\frac{15x}{24} = \frac{242}{23} \quad \underline{16.8 = x}$$

8. Solve the following x:

$$156 = 23x(14 + 12) \quad \underline{x = 0.26}$$

9. Solve the following x:

$$23x = \frac{15}{52} \quad \underline{x = 0.013}$$

10. Solve the following x:

$$146x(24) = \frac{234}{55} \quad \underline{x = 0.0012}$$

11. Solve the following x:

$$\log \left(\frac{(10+x)^2}{243} \right) = 12$$

$$\begin{aligned} \log(10+x)^2 - \log(243) &= 12 \\ \log(10+x)^2 &= 14.4 \\ (10+x)^2 &= 10^{14.4} \end{aligned}$$

$$\begin{aligned} \sqrt{(10+x)^2} &= \sqrt{2.5 \times 10^{14}} \\ 10+x &= 15848932 \\ \boxed{x} &= 15848922 \end{aligned}$$

12. Solve the following x:

$$\log(2) + \left[\sqrt{(24-x)^4} \right] = 23$$

$$\begin{aligned} \sqrt{(24-x)^4} &= 22.7 \\ (\sqrt{(24-x)^4})^2 &= (22.7)^2 \\ [(24-x)^4]^{1/4} &= [515.29]^{1/4} \end{aligned}$$

$$\begin{aligned} 24-x &= 4.8 \\ \boxed{x} &= 19.2 \end{aligned}$$

13. Solve the following x:

$$\left[\sqrt{(12-x)^{2.5}} \right]^{1.5} = [23.6]^{1.5} \quad 12-x = 3.54$$

$$\boxed{x = 8.46}$$

14. Solve the following x:

$$\log \left(\frac{\sqrt{(23-x)^3}}{53} \right) = 4$$

$$\log \sqrt{(23-x)^3} - \log(53) = 4$$

$$\log \sqrt{(23-x)^3} = 6.18$$

$$\sqrt{(23-x)^3} = 10^{6.18}$$

$$(\sqrt{(23-x)^3})^2 = (1513561.2)^2$$

$$[(23-x)^3]^{1/3} = [2.3 \times 10^{12}]^{1/3}$$

15. Solve the following x:

$$243 - \ln 14 \left(\frac{\sqrt{(45-x)^5}}{75} \right) = 132$$

$$-\ln 14 \left[\frac{\sqrt{(45-x)^5}}{75} \right] = 132 - 243$$

$$\frac{\sqrt{(45-x)^5}}{75} = \frac{132-243}{-\ln 14}$$

$$\sqrt{(45-x)^5} = \frac{132-243}{-\ln 14} \cdot 75$$

$$\left(\sqrt{(45-x)^5} \right)^2 = \left(\frac{132-243}{-\ln 14} \cdot 75 \right)^2$$

$$[(45-x)^5]^{1/5} = (9951094.1)^{1/5}$$

$$45-x = 25.1$$

$$\boxed{x = 19.9}$$

Practice Test: Conversions

- Convert 32.5 inches into meters.

$$32.5 \text{ in} \times \frac{2.54 \text{ cm}}{1 \text{ in}} \times \frac{1 \text{ meter}}{100 \text{ cm}} = \underline{0.83 \text{ meters}}$$
- Convert 130 cubic feet of water to read in liters.

$$130 \text{ ft}^3 \times \frac{1 \text{ liter}}{0.03531 \text{ ft}^3} = \underline{3682 \text{ l}}$$
- Convert 2,354 feet into meters.

$$2354 \text{ ft} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} \times \frac{1 \text{ m}}{100 \text{ cm}} = \underline{717.5 \text{ m}}$$
- Convert 1,500 yards into miles.

$$1500 \text{ yds} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{1 \text{ mile}}{5280 \text{ ft}} = \underline{0.85 \text{ miles}}$$
- 5,233 lbs is equal to how many grams?

$$5233 \text{ lbs} \times \frac{1 \text{ kg}}{2.2 \text{ lbs}} \times \frac{1000 \text{ g}}{1 \text{ kg}} = \underline{2378636.4 \text{ g}}$$
- A depth of 20,000 feet is equal to how many centimeters?

$$20,000 \text{ ft} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} = \underline{609600 \text{ cm}}$$
- 625,000 gram piece of equipment is equivalent to how many pounds?

$$625,000 \text{ g} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{2.2 \text{ lbs}}{1 \text{ kg}} = \underline{1375 \text{ lbs}}$$
- Height of 38,000 feet is equivalent to how many kilometers?

$$38,000 \text{ ft} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} \times \frac{1 \text{ meter}}{100 \text{ cm}} \times \frac{1 \text{ km}}{1000 \text{ m}} = \underline{11.6 \text{ km}}$$
- Convert 2300 milligrams per liter of liquid into pounds per gallon.

$$2300 \frac{\text{mg}}{\text{l}} \times \frac{1 \text{ l}}{1.06 \text{ qts}} \times \frac{4 \text{ qts}}{1 \text{ gal}} \times \frac{1 \text{ gr}}{1000 \text{ mg}} \times \frac{1 \text{ kg}}{1000 \text{ gr}} \times \frac{2.2 \text{ lbs}}{1 \text{ kg}} = \underline{0.02 \frac{\text{lbs}}{\text{gal}}}$$
- Convert 24,000 kilograms per cubic feet of air into pounds per liter.

$$24,000 \frac{\text{kg}}{\text{ft}^3} \times \frac{2.2 \text{ lbs}}{1 \text{ kg}} \times \frac{0.03531 \text{ ft}^3}{1 \text{ l}} = \underline{1864.4 \text{ lbs/l}}$$
- Convert 150 pounds per square feet into grams per square inches?

$$150 \frac{\text{lbs}}{\text{ft}^2} \times \frac{1 \text{ kg}}{2.2 \text{ lbs}} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ ft}^2}{144 \text{ in}^2} = \underline{473.5 \frac{\text{g}}{\text{in}^2}}$$
- A sling load tested for 240 lbs is equivalent to how many grams?

$$240 \text{ lbs} \times \frac{1 \text{ kg}}{2.2 \text{ lbs}} \times \frac{1000 \text{ g}}{1 \text{ kg}} = \underline{109091 \text{ g}}$$
- 42,000 pounds per square inch is equivalent to how many kilograms per square foot?

$$42000 \frac{\text{lbs}}{\text{in}^2} \times \frac{1 \text{ kg}}{2.2 \text{ lbs}} \times \frac{144 \text{ in}^2}{1 \text{ ft}^2} = \underline{2749091 \text{ kg/ft}^2}$$
- Floor is load tested to be 45 lbs per square foot. If floor total square footage is 320 square feet, how many total kilogram weight is allowed?

$$320 \text{ ft}^2 \times \frac{45 \text{ lbs}}{1 \text{ ft}^2} = 14,400 \text{ lbs} \times \frac{1 \text{ kg}}{2.2 \text{ lbs}} = \underline{6545.5 \text{ kg}}$$
- If cement mixing requires 2 gallons of water for every 5 pounds of cement, how many liters of water do you need for 230 pounds of cement?

$$230 \text{ lbs} \times \frac{2 \text{ gal}}{5 \text{ lbs}} \times \frac{1.25 \text{ qts}}{1 \text{ gal}} \times \frac{1 \text{ liter}}{1.06 \text{ qts}} = \underline{347.2 \text{ l}}$$

Practice Test#3
Geometry and Trigonometry

1. A cylindrical water storage tank must hold a volumetric capacity of 300,000 gallons to serve a population of 150 people. The commercial property where this tank must be built can only fit a tank with a diameter of 12 feet. How high in feet should the tank be constructed?

$$V = \frac{\pi d^2 h}{4} \quad V = 300,000 \text{ gals} \times \frac{4 \text{ qts}}{1 \text{ gal}} \times \frac{0.03531 \text{ ft}^3}{1.06 \text{ qt}} = 39,974 \text{ ft}^3$$

$$39,974 \text{ ft}^3 = \frac{\pi (12 \text{ ft})^2 h}{4}$$

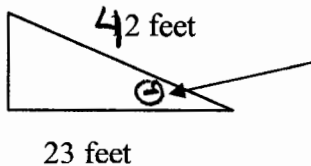
$$\underline{353 \text{ ft} = h}$$

2. A fuel truck requires its tanks to be drained. Assume that the fuel truck is full to its capacity. It is exactly 30 minutes to closing time. A fuel pump has a pumping capacity of 120 gallons per minute. If the diameter of the tank is 15 feet and the height is 20 feet, will there be enough time to safely empty the truck before closing time.

$$V = \frac{\pi d^2 h}{4} = \frac{\pi (15)^2 (20)}{4} = 3534.3 \text{ ft}^3 \times \frac{1.06 \text{ qts}}{0.03531 \text{ ft}^3} \times \frac{1 \text{ gal}}{4 \text{ qts}} = 26525 \text{ gal}$$

$$26525 \text{ gal} \times \frac{1 \text{ min}}{120 \text{ gal}} = 221 \text{ min} > 30 \text{ min}; \text{ NO TIME}$$

3. Given the following values, calculate the angle indicated.



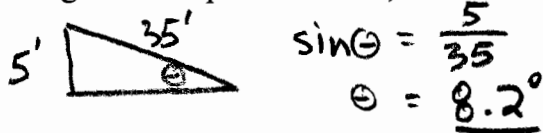
$$\cos \theta = \frac{23}{42} =$$

$$\theta = \underline{57^\circ}$$

4. What is the incline if a driveway rises 5 feet from ground level, and has a total driveway length of 35 feet?

$$\underline{14.3\%} = 100 \times \frac{5}{35}$$

5. Using the same problem as #4, what is the angle of the ramped driveway?



$$\sin \theta = \frac{5}{35}$$

$$\theta = \underline{8.2^\circ}$$

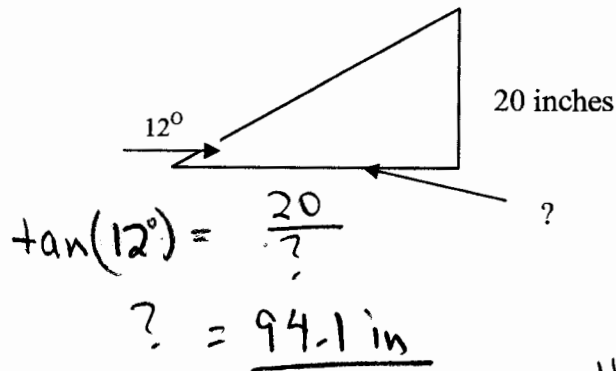
6. A storm is coming and all of the fuel tanker trucks are required to be emptied and purged. A fuel tanker truck with a radius of 12 feet and a height of 23 feet is full of fuel. With 2 fuel pumps both pumping at 110 gallons per minute, how long, expressed in minutes, will it take to empty the tanker?

$$V = \frac{\pi d^2 h}{4} = \frac{\pi (12+12)^2 (23)}{4} = 10405 \text{ ft}^3 \times \frac{1.06 \text{ qts}}{0.03531 \text{ ft}^3} \times \frac{1 \text{ gal}}{4 \text{ qts}} = 78089 \text{ gals}$$

$$\text{Pump RATE} = 2 \times \frac{110 \text{ gal}}{\text{min}} = 220 \text{ gal/min}$$

$$78089 \text{ gals} \times \frac{1 \text{ min}}{220 \text{ gal}} = \underline{355 \text{ min}}$$

7. Given the following right triangle, determine the length as indicated with the arrow.



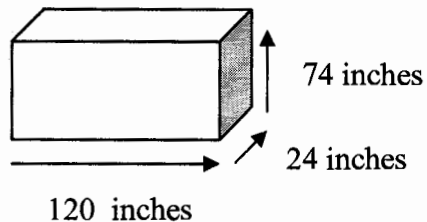
there is 250,000

8. If a room requires 55 m³ of clean air per person and the room volume is ~~250,000~~ cubic feet, how many people maximum is allowed to safely be in this room to work for an 8-hour day?

$$250,000 \text{ ft}^3 \times \frac{1 \text{ m}^3}{0.03531 \text{ ft}^3} \times \frac{16.4 \text{ cm}^3}{1 \text{ in}^3} \times \frac{1 \text{ m}^3}{1 \times 10^6 \text{ cm}^3} = 116 \text{ m}^3$$

$$116 \text{ m}^3 \times \frac{1 \text{ person}}{55 \text{ m}^3} = 2 \text{ persons}$$

9. Given the following figure, how long would it take to fill the room with air (assuming it had no air to begin with) if the air compressor can only produce 23 cubic feet of air per minute.



$$120 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 10 \text{ ft}$$

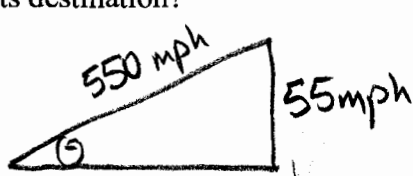
$$24 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 2 \text{ ft}$$

$$74 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 6 \text{ ft}$$

$$V = 10' \times 2' \times 6' = 120 \text{ ft}^3$$

$$120 \text{ ft}^3 \times \frac{1 \text{ min}}{23 \text{ ft}^3} = 5.2 \text{ min}$$

10. An aircraft with an air speed of 550 miles per hour is meeting 90-degree crosswinds from the left. The crosswinds are about 55 miles per hour. What course correction (or angle relative to its current straight line heading) is required to compensate in order to reach its destination?



$$\sin \theta = \frac{55}{550}$$

$$\theta = 5.7^\circ$$

11. Safety section is conducting a design review of a fuel tank design. The tank is 130 feet in diameter at its base, and 55 feet high. The containment system must be able to hold 110% of the tank's fuel capacity, if there was a leak. Therefore, what is the maximum capacity that you should expect the containment system to hold in gallons?

$$V = \frac{\pi d^2 h}{4} = \frac{\pi (130')^2 (55)}{4} = 730028 \text{ ft}^3 \times \frac{1.06 \text{ qt}}{0.03531 \text{ ft}^3} \times \frac{1 \text{ gal}}{4 \text{ qt}} = 5,478,825 \text{ gals}$$

$$5,478,825 \times 1.10 = \underline{6,026,708 \text{ gals}}$$

12. A design engineer wants to design a ramp to the storage warehouse for forklifts to carry their loads. The ramp is 30 feet long and 4 feet high. The manufacturer of the forklift recommends a maximum incline of 6% when carrying its maximum load test capacity. Assuming that the forklifts are expected to carry up to their maximum load test, is this design within the manufacturer's recommendations?

$$\frac{4'}{30'} \times 100 = 13\% > 6\% \text{ incline}$$

NO

Practice Test#4
Engineering and Physics Review Part I

1. A tower crane must lift a load weighing 1500 lbs. Its counterweight is located 60 feet from the mast. If the load is lifted about 100 feet from the mast, how much counterweight in pounds is required?

$$F_1 D_1 = F_2 D_2$$

$$(1500)(100) = F_2 (60)$$

$$\underline{2500 \text{ lbs} = F_2}$$

2. A demolition crane holds a 15 short ton solid ball for tearing down walls. At a height of 50 feet, how much potential energy does it possess?

$$15 \text{ tons} \times \frac{2,000 \text{ lbs}}{1 \text{ ton}} = 30,000 \text{ lbs}$$

$$PE = mgh$$

$$= (30,000)(32.2)(50')$$

$$= \underline{48,300,000 \text{ ft-lbs}}$$

3. During an accident investigation, an engineer, reviewing the damaged structure, estimated that approximately 150,000 ft-lbs/sec² of force had impacted into a store's structure. If the car involved weighed 2200 lbs, how fast in miles per hour must the car have traveled when it crashed?

$$K = \frac{mv^2}{2} = 150,000 \text{ ft-lb/sec}^2 = \frac{68.3 \text{ lbs}}{2} v^2$$

$$\frac{66.3 \text{ ft}}{\text{sec}} \times \frac{3600 \text{ sec}}{1 \text{ hr}} \times \frac{1 \text{ mi}}{5280 \text{ ft}} = 45 \text{ mph}$$

$$66.3 \text{ ft/sec} = v$$

$$W = mg$$

$$\frac{2200}{32.2} = m = 68.3 \text{ lbs}$$

4. A warehouse has a 1,000 lb forklift, which can exert 1,000 lbs onto any load. There is a 5 degree ramp with a coefficient of friction of 0.15. What is the maximum load that the forklift can keep an object from slipping off a ramp?



5. As a safety officer on-site, a supervisor comes to you to advise that he wants 2500 lbs of steel girter lifted onto a commercial building under construction. The tower crane on-site has a counterweight of 20 short tons located 55 feet from the mast. What is the maximum distance from the mast that the load can safely be lifted? 1 short ton = 2000 lbs

$$20 \text{ short tons} \times \frac{2000 \text{ lbs}}{1 \text{ short ton}} = 40,000 \text{ lbs}$$

$$F_1 D_1 = F_2 D_2$$

$$(40,000)(55') = (2500 \text{ lbs}) D_2$$

$$\underline{880 \text{ lbs} = D_2}$$

6. Using Problem# 5, the supervisor needs the 2500 lbs of steel girter transported at an area requiring the tower crane to reach 200 feet from its mast. Given the information in Problem#5, is that OK.

$$F_1 D_1 = F_2 D_2$$

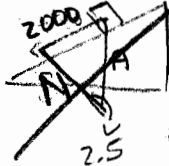
$$F_1 (55') = (2500 \text{ lbs})(200 \text{ ft})$$

$$F_1 = 9091 \text{ lbs counterweight required}$$

$$F_1 < 40,000 \text{ lbs}$$

YES - OK

7. A 2000 lbs forklift is holding an object on ramp, which is inclined about 2.5 degrees. The coefficient of friction is 0.10. How much must this object weigh, in pounds?



$$\tan 2.5 = \frac{2000}{N}$$

$$N = \frac{2000}{\tan 2.5}$$

8. In another vehicle accident investigation, an engineer estimates that the structural damaged was caused by about 135,000 ft-lb per sec² of energy. The car involved was estimated to have traveled 85 miles per hour. How much did the car weigh? (hint: not the mass, the weight). $K = \frac{mv^2}{2}$

$$K = \frac{mv^2}{2} \quad \frac{85 \text{ miles}}{1 \text{ mi}} \times \frac{1 \text{ hr}}{3600 \text{ sec}} \times \frac{5280 \text{ ft}}{1 \text{ mile}} = 125 \text{ fps}$$

$$135,000 = \frac{m(125)^2}{2}$$

$$17.3 \text{ lbs} = m$$

$$W = mg$$

$$(17.3 \text{ lbs})(32.2) = 557 \text{ lbs}$$

9. Using Problem#8 above, what is the equivalent height needed, if you raised the car and dropped it, in order to attain the same kinetic energy?

$$PE = mgh$$

$$135,000 = (557 \text{ lbs})(32.2) h$$

$$7.5' = h$$

10. A tower crane has a standard counterweight of 345,000 ft-lbs with a distance of 20 feet from the tower's mast. Is it sufficient to lift a 12,000 lb load at a distance of 40 feet from the mast? If not, how much additional counter moment, in ft-lbs, is required?

$$= (345,000)(20) = 6,900,000 \text{ ft-lbs} = \text{COUNTER MOMENT}$$

$$(12,000)(40) = 480,000 \text{ ft-lbs}$$

$$\text{COUNTER MOMENT} > \text{MOMENT}$$

YES

11. A wheeled cart requires about 25 lbs of pushing force to move a load weighing 450 lbs. The cart weighs 135 lbs. What is the coefficient of friction of the ground?

(Obviously, assume that this ground is level.)

$$N = 135 \text{ lbs} + 450 \text{ lbs} = 585 \text{ lbs}$$

$$F = 25 \text{ lbs}$$

$$F = \mu N \Rightarrow \mu = \frac{25 \text{ lbs}}{585 \text{ lbs}} = 0.04$$

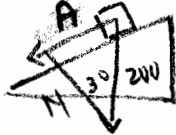
12. A truck weighing 10,000 pounds is traveling at 65 miles per hour. How much kinetic energy is being developed? $W = mg \Rightarrow m = \frac{10,000 \text{ lbs}}{32.2 \text{ ft/sec}^2} = 311 \text{ lbs}$

$$K = \frac{(311)(95.3)^2}{2}$$

$$= 141,226.5 \text{ ft-lb}$$

$$\frac{65 \text{ mi}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{3600 \text{ sec}} \times \frac{5280 \text{ ft}}{1 \text{ mi}} = 95.3 \text{ fps}$$

13. What force is required to keep a load weighing 200 lbs from moving down a ramp, which is inclined at 3 degrees and has a coefficient of friction of .13?



$$F = \mu N$$

$$= .13 (199.7 \text{ lbs})$$

$$= 25.96 \text{ lbs}$$

$$\cos 3^\circ = \frac{N}{200}$$

$$199.7 \text{ lbs} = N$$

$$10.5 \text{ lbs} < 25.96 \text{ lbs}$$

$$\sin 3^\circ = \frac{A}{200}$$

$$10.5 = A$$

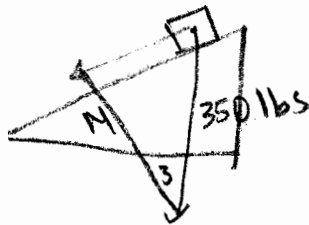
NO
FORCE
REQ →

0 lbs

14. How much force in Problem#13 is required to push the load up this ramp?

$$25.96 \text{ lbs} + 10.5 \text{ lbs} = \underline{36.46 \text{ lbs}}$$

15. Using Problem#13, except this time, you have a 350 lb load, how much force is needed to push it up the ramp?



$$\cos 3^\circ = \frac{N}{350 \text{ lbs}}$$

$$349.5 = N$$

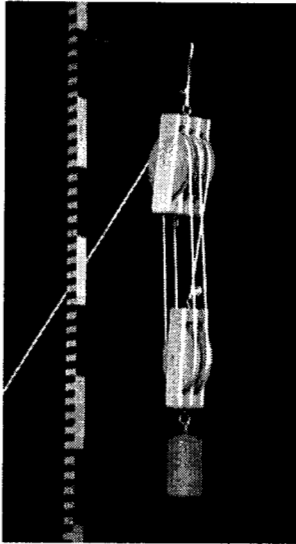
$$F = \mu N = (.13)(349.5) = 45.4 \text{ lbs}$$

Frict. Force

$$45.4 + 349.5 = \underline{394.94 \text{ lbs}}$$

Practice Test#5
Engineering and Physics Part II

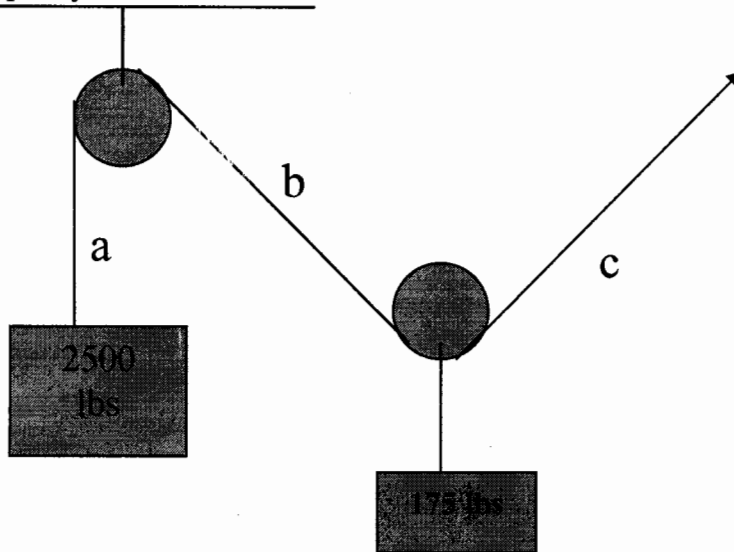
1.



This block and tackle has 8 lines and is expected to carry 1500 lbs. How much force, as shown, will be required to lift the load?

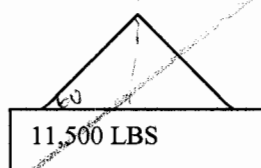
$$\frac{1}{8}(1500) = \underline{214 \text{ lbs}}$$

2. What is the amount of force on c, then, to pull the 2500 lb load in the system?
Assume pulleys are frictionless.



$$\frac{1}{2} (175) = \underline{87.5 \text{ lbs}}$$

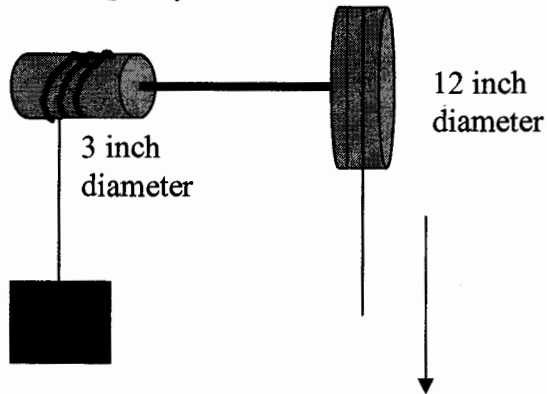
3. A 2 rope sling is supporting a 11,500 lb load. If the sling angle to the load is 60 degrees, how much force is imposed on the left sling?



$$\cos 60^\circ = \frac{11500}{X}$$

$$X = \underline{23,000 \text{ lbs}}$$

4. A 3-inch diameter pulley is a line to a 250 lbs load. The 3-inch pulley is then attached with a rod to a large 12-inch pulley. How much downward pull with the rope on the large 12-inch pulley do I need to lift the 250 lbs load up?



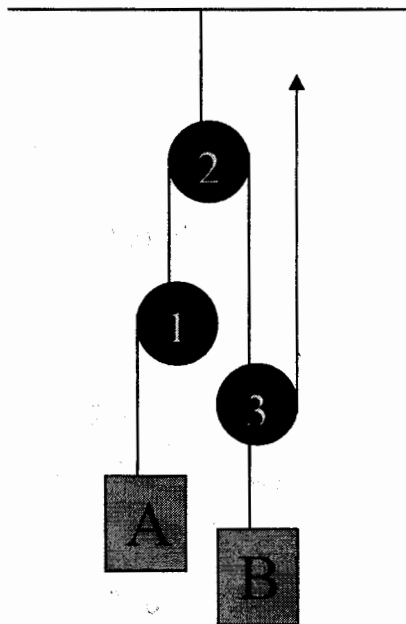
$$F_1 D_1 = F_2 D_2$$

$$(250)(3) = F_2 (12)$$

$$62.5 = F_2$$

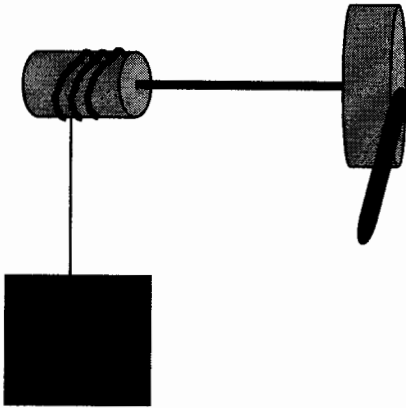
$$\underline{165}$$

5. If load A is 200 lbs and load B is 74 lbs, how much upward force do I need to pull to keep the loads in equilibrium?



$$\frac{1}{3} (74) = \underline{25 \text{ lbs}}$$

6. A handle measuring 12 inches is attached to this 6 inch large pulley. There is a smaller 3 inch pulley. How many of pounds of force is required on the handle to lift the object weighing 230 lbs?



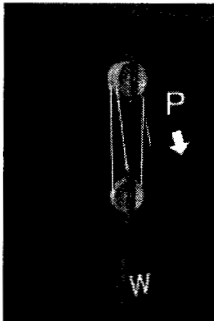
$$F_1 D_1 = F_2 D_2$$

$$(230)(3) = F_2 (12)$$

$$57.5 = F_2$$

$$\underline{1 \text{ bs}}$$

7. A newbie who only weighs 135 lbs shows up to work at a construction site. The supervisor breaks him into the job by having him lift 450 lbs of cement bags to folks on a higher level. How much downward force is needed to lift the load assuming that the newbie only has a maximum pulling force of 115 lbs?



$$4 - 1 = 3$$

$$\frac{1}{3} (450 \text{ lbs}) = \underline{150 \text{ lbs}}$$

$$150 \text{ lbs} > 115 \text{ lbs}$$

8.



$$L_L = \frac{\text{LOAD}}{n} (1 + F_f)^n$$

$$= \frac{114,000}{8} (1 + .20)^8$$

$$= 61,272.4 \text{ lbs}$$

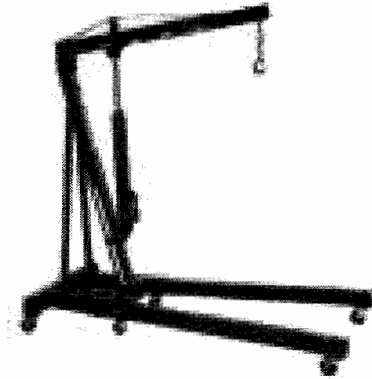
A boom operator is asked to lift a 114,000 lb load onto a tractor trailer. His wire rope is 8 parts line and the pulley has friction factor of 20%. The boom operator lost his operator's manual so you do not have any idea what the Safe Working Load is. The wire rope looks in very good condition, though. Assuming that you want the wire rope SWL to be 5 times the load as a good safety measure, can the operator safely lift this load within the estimated SWL that you calculate? DIAMETER = 1.5"

$$\text{SWL} = (1.5)^2 \times 8 = 18 \text{ tons} = 36,000 \text{ lbs}$$

NOT SAFE TO LIFT

$$L_L > \text{SWL}$$

9.



$$L_L = \frac{\text{Load}}{n} (1 + F_f)^n$$

$$= \frac{1150}{4} (1 + .15)^4$$

$$= 503 \text{ lbs}$$

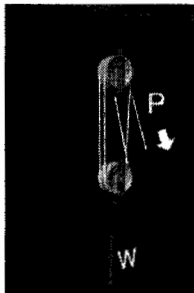
$$\text{SWL} = (1)^2 \times 8 = 8 \text{ tons} = 16,000 \text{ lbs}$$

$$\frac{16000}{503} \approx 32 \text{ times}$$

This mobile lifting device is needed to lift a large automobile engine. The engine with an attached heating block is approximately 1150 lbs. The wire rope here is 4 parts line and the pulley has a 15% friction factor. Again, the auto shop lost the manufacturer's operator manual. Based upon the estimated SWL, can this device safely lift the engine in question assuming that you want a 5 to 1 ratio between the SWL and the engine weight.

DIAMETER = 1.0"

10.



Newbie is back on the job. This time, the supervisor rigs a different pulley. Using the same 450 lb cement bags being lifted up to a higher level, can Newbie do it? Note that because Newbie is still hurting from yesterday's job, he is only able to give a force of only 90 lbs.

$$5-1 = 4 \quad \frac{1}{4} (450) = 113 \text{ lbs} < 90 \text{ lbs}$$

NO

Practice Test
Basic Industrial Hygiene

1. During a sound level survey of a small generator, you measured 105 dB at a distance of 1 foot from the generator. At what distance from the generator is required a Safe

- Distance to be at a 85 dB level? $dB_1 = dB_0 + 20 \log \frac{d_0}{d_1}$
 $85 = 105 + 20 \log \frac{1}{d_1}$
 $\underline{10'} = d_1$
- a. 10 Feet
 b. 15 Feet
 c. 20 Feet
 d. None of the Above

2. You received an Industrial Hygiene report where a worker was exposed to benzene at .2 ppm for 2 hours, and later, .05 ppm for 6 hours. What was the Time Weighted Average for this worker?

- TWA = $\frac{(0.2 \cdot 2 \text{ hrs}) + (0.05 \cdot 6 \text{ hrs})}{8}$
 = 0.09 ppm
- a. 1.0 ppm
 b. 0.09 ppm
 c. 0.2 ppm
 d. 0.3 ppm

3. This particular industrial process releases about 1 pint of solvent per hour. Each pint of this Chemical X releases about 2 cubic feet of vapor. Using a Safety Factor of 2, what is the minimum amount of ventilation required to reduce the concentration to below

- 1.0%? $Q = \frac{G}{C}$ where $C = \frac{LEL}{100} \times \frac{1 \text{ pt}}{60 \text{ min}} \times \frac{2 \text{ ft}^3}{1 \text{ pt}} = 0.033 \text{ cfm}$
 $= \frac{G}{LEL} \times 100$
 $= \frac{0.067}{1} \times 100 = \underline{6.7 \text{ cfm}}$
 $\frac{0.033 \text{ cfm} \times 2}{0.067 \text{ cfm}}$
- a. 10 cfm
 b. 6.7 cfm
 c. 8.2 cfm
 d. 5.0 cfm

4. There are three Navy seamen applying metal primer and coating inside one of the ship's quarters. Industrial Hygiene survey determined that the primary component, Toluene, was measured at 200 ppm TWA even with the doors open to the outside. What is the minimum respirator protection level required using a Threshold Limit Value of 50 ppm?

- PF = $\frac{200}{50} = 4$; HALF FACE - 10 IS CLOSEST
- a. Half-Face
 b. Full-Face
 c. Powered Air Purifying
 d. Airline

5. During a noise survey, you measured, using a sound level meter placed near the worker's ear, the following measurements: 103 dB for 2 hours, 95 dB for 3 hours, and 97 dB for 3 hours. What was the noise dose for this individual?

- a. 100%
 b. 200%
 c. 300%
 d. 400%
- $T = \frac{8}{2^{(L-90/5)}}$
 $T_{103 \text{ dB}} = 1.32$
 $T_{95 \text{ dB}} = 4.0$
 $T_{97 \text{ dB}} = 3.03$
 NOISE DOSE = $100 \left[\frac{1.32}{2} + \frac{4.0}{3} + \frac{3.03}{3} \right]$
 = 300%

Practice Test
Statistics

1. While reviewing tank rollovers across the Marine Corps and Army services, you determined a death rate of 2.5 per 100,000. On your Marine Corps Base where you have a total of 850 tank crewmembers, one is the probability that you have exactly 1 active duty death due to tank rollovers this year?

- a. 1%
- ☒ b. 2%
- c. 3%
- d. 4%

$$850 \times \frac{2.5}{100,000} = 0.021 = \lambda$$

$$P = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$= \frac{(0.021)^1 e^{-(0.021)}}{1!}$$

$$= 0.021 = \underline{2\%}$$

2. During a sound level survey, you measured the following readings in the exact spot inside a industrial facility: 77 dB, 83 dB, 85 dB, 79 dB, 82 dB. What is the average of these measurements?

- a. 80.2
- ☒ b. 81.2
- c. 82.2
- d. 83.2

3. For Problem#2 above, what is the standard deviation?

- a. 3.0
- ☒ b. 3.2
- c. 4.0
- d. 5.0

$$S = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

4. Your office recently bought a new noise meter, but you are not sure if it is more precise than your previous older model. The new noise meter, designated Noise Meter A, is taken to the field and used in 10 different locations to measure sound in the dBA scale. Here, the mean was 85 dB with a standard deviation of 3.0. The older noise meter, designated Noise Meter B, was taken to the same sites and the same time as Noise Meter A. Here, the readings from Noise Meter B had a mean of 87 dB with a standard deviation of 3.5. Which noise meter had better precision?

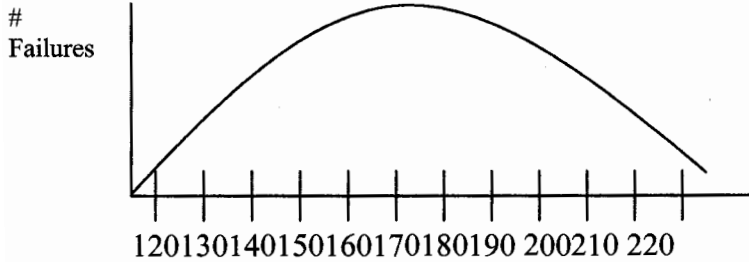
- a. Noise Meter B
- ☒ b. Noise Meter A
- c. Both have same level of precision

$$CV_A = 100 \left(\frac{SD}{\bar{x}} \right) ; CV_B = 100 \left(\frac{SD}{\bar{x}} \right)$$

$$= 100 \left(\frac{3}{85} \right) ; = 100 \left(\frac{3.5}{87} \right)$$

$$= 3.5 \quad = 4.02$$

5. As a safety officer for Security Cameras, Inc, you have been tracking the failure rates of Security Model A Camera units. Based upon the graph below, a mean failure rate at 170 Days of constant use, and a Standard Deviation of 100, what is the probability that the back-up unit will fail at 210 hours of service?



- a. 20%
- b. 30%
- c. 50%
- d. 65%

$$z = \frac{(x - \bar{x})}{SD} = \frac{210 - 170}{100} = 0.4$$

$$z\text{-TABLE} \Rightarrow 0.1554$$

$$0.50 + .1554 = .6554 \Rightarrow \underline{65.5\%}$$